Conducting Biomaterials for Nerve Regeneration

Grant R44 NS41686-02 | Period of support: 09/2004 – 06/2007

Background:

- Intrinsically Conducting Polymers (ICP) may be used to deliver electrical stimulation to cells
- Direct and pulsed currents can accelerate cell growth and proliferation
- Application of electrical potential to PC-12 cells (neuron-like) doubles neurite growth
- ICP may be used as coatings in Nerve Guidance Channels (NGCs) to speed-up nerve re-growth after peripheral nerve injury

Problem:

- ICPs are not biodegradable
- ICPs are untreatable powders that cannot be processed or formed
- ICPs properties are difficult to tune

Objectives:

- Develop new ICP block copolymers that are:
  - biodegradable
  - can be processed from solvent dispersions
  - have tunable and controllable properties
- Assess new materials for neuron growth and nerve regeneration:
  - in vitro (with and without electrical stimulation)
  - in vivo (rat sciatic nerve model)

Business and Point of Contact :

TDA Research, Inc., 12345 West 52nd Avenue, Wheat Ridge Colorado, 80033 - www.tda.com
Dr. Silvia Luebben, silvia@tda.com, (303) 940-2317

TDA Research

Collaborator:

Department of Chemical Engineering, University of Texas at Austin
Dr. Christine Schmidt, schmidt@che.utexas.edu, (512) 471-1690

Progress:

Completed synthesis of several ICP block copolymers that:

- can be spin cast from solvent dispersions
- have tunable conductivities up to 32 S/cm, and tunable dopant
- are biocompatible and degradable
- have shown preliminary positive results in proliferation studies with PC-12

Current Challenges:

- Improve mechanical properties of films
- Find experimental conditions to carry out reproducible and meaningful electrical stimulation experiments.

Near Term Product:

A processable and biodegrdable conducting biomaterial for making devices and implants (including coated NGCs) that can deliver electrical stimulations to cultured cells or in vivo organs.

Future Plans:

-Improve polymer properties
-Complete characterization of polymers
- Complete electrical stimulation studies
-Carry out in vivo studies (NGCs in rat sciatic nerve)

Keywords:

Conducting biomaterials, Biodegradable polypyrrole, Stimuli responsive biomaterials, Nerve regeneration, Neuron stimulation